

Monterey Bay National Marine Sanctuary

Landslide Management along the Big Sur Coastline

Management Issue

The ability of managers to adequately protect Monterey Bay National Marine Sanctuary (MBNMS or Sanctuary) nearshore habitats in the Big Sur region from landslide debris is hindered by incomplete knowledge of the oceanography, biology, and geology surrounding landslide sites.

Description

Adjacent to MBNMS, the Big Sur coastline along the central coast of California is a spectacular meeting of land and ocean characterized by high cliffs, rugged canyons and crashing surf. This is also an area in the sanctuary where the continental shelf hugs the coastline, and several deep offshore canyons define a special component of the marine ecosystem. Highway 1 along the geologically diverse Big Sur coastline has a long history of landslides that have both landed on the highway and undermined the roadbed. In conducting landslide repair work on Highway 1 prior to the designation of the Sanctuary, maintenance practices of the California Department of Transportation (Caltrans) often involved

moving landslide and road repair soils shoreward. Maintenance and catastrophic road repair activities sometimes deviated considerably from the natural patterns of slide movement and sediment dispersion in marine systems. The deposition of landslide debris affects marine habitats and biological communities by direct burial, sand scour and plumes of fine suspended sediment. Sanctuary regulations prohibit the discharge of material within its boundaries, and prohibit the disposal of material outside the sanctuary boundaries that subsequently enters the sanctuary and harms resources. Following a severe landslide season in 1998, Caltrans led the development of the Coast Highway Management Plan (CHMP) to create a decision framework to guide the deposition of slide debris. The CHMP was an excellent start, but MBNMS still lacks a complete survey of marine resources along typical landslide areas and sites where Caltrans may seek to deposit rock and soil debris onto or above the shoreline, which in turn may move into the ocean. Collaborative management and interagency partnerships can be better informed through the integration of biological, geological, and oceanographic knowledge about the habitat areas surrounding landslide sites.



Landslide in Big Sur, with slide debris entering the MBNMS.

Photo credit: Tampa Bay Times.

Questions and Information Needs

- 1) At what types of locations have slide activities of different magnitudes been most concentrated in the past?
- 2) Which areas along the Big Sur coastline are more or less susceptible to landslides in the next century?
- 3) What is the biology and geology associated with historic slides and future slide areas, and what are the major habitat types in associated intertidal and subtidal areas?
- 4) In potentially affected areas, what are the nearshore patterns of water movement, sand movement/littoral cells, and exposure to wave energy?
- 5) Where have historic accumulations of slide debris dispersed to, and where might debris be transported within the marine environment in the future?
- 6) What are the ecological impacts of slide debris on intertidal and shallow subtidal communities?

Scientific Approach and Actions

- Develop updated maps showing recent and historic slides and Caltrans management activities, including past deposition sites and volume of material
- Develop updated maps showing predicted slide areas, with high/medium/low risk rankings
- Conduct research, characterization and monitoring of the intertidal and nearshore subtidal resources, and seabird and marine mammal aggregation areas below the highway
- Develop maps of intertidal and subtidal geology types, along with associated biota

Updated: 8/31/2012

For More Information -- <http://www.sanctuaries.noaa.gov/science/assessment>

Scientific Approach and Actions *(continued)*

- Conduct shallow benthic mapping of substrate type and topography/bathymetry at high resolution
- Using the shoreline sensitivity assessment conducted by PISCO and additional data, develop a map of major intertidal and subtidal habitat types
- Create high-resolution visualizations of nearshore patterns of water movement, sand movement/littoral cells, and wave energy
- Create a map that links landslide photos and videos to specific locations

Key Partners and Information Sources

U.S. Geological Survey, California Geological Survey, Bureau of Ocean Energy Management, Caltrans, U.S. Fish and Wildlife Service, U.S. Forest Service, California State Parks, California State Water Resources Control Board, California Coastal Commission, Bureau of Land Management's California Coastal National Monument, California State University Monterey Bay, UC Santa Cruz



*Crews managed by Caltrans clear debris from the 2011 Alder Creek Slide. Caltrans and MBNMS work together to minimize the impacts of debris deposition.
Photo credit: <http://blogbigsur.wordpress.com/>*

Management Support Products

- Visualization of historic slide hot spots by magnitude of debris material deposited over time
- Increased ability to predict the properties of different types of geology in the Big Sur region
- Improved predictions of offshore sediment transport along the Big Sur coast, including estimating natural inflows and outputs, and physical characteristics of deposited sediment
- Decision-making protocols that minimize ecological impacts of road maintenance debris deposition

Planned Use of Products and Actions

- Integration of new data products with GIS data layers from other agencies
- Enhanced avoidance of debris deposition at critical, sensitive habitats and identification of areas with lower resource value that may be suitable for ocean deposition of rock and soil by Caltrans
- Slide debris decision-making will be able to incorporate predicted impacts to downcoast or upcoast ecological communities where debris may be transported by currents

Program References

MBNMS Management Plan

- Big Sur Coastal Ecosystem Action Plan, Strategy BSP-1, BSP-2, BC-4
- Tidepool Protection Action Plan, Strategy TP-7

MBNMS Condition Report

- What is the abundance and distribution of major habitat types and how is it changing? (Nearshore Environment - Question 5)
- What are the levels of human activities that may influence living resource quality and how are they changing? (Nearshore Environment – Question 14)

ONMS Performance Measures

- By 2015, 100% of the sanctuary system will be adequately characterized
- Number of sites in which select living marine resources (LMRs), based on long-term monitoring data, are being maintained or improved
- Number of sites in which habitat, based on long-term monitoring data, is being maintained or improved

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